sideration the subgenera which are not numbered, and which we are afraid to count. Then, the authors have adopted a set of rules which, when applied to ichthyology, make the greatest possible disturbance in previously accepted nomenclature. So-called rules of priority are made retrospective, uniformly and pedantically: reasons which induced elder authors to select certain names for their genera are set aside, and not even Linnæus himself is allowed to change his own names; no regard is to be paid to the character and spirit of a work in which the names take their origin; a name by a Rafinesque or Swainson deserves as much consideration as one given by Cuvier or Rüppell. Both these methods result in a nomenclature which is more or less difficult to grasp by a European systematist.

Finally, we have to refer to the manner in which the authors have dealt with "synonymy." This seems to us too scanty to satisfy the wants of the student either of systematic ichthology or of the American fauna. The authors announce as the principle by which they have been guided, to give "enough synonymy to connect this work with other descriptive works, and no more"; and of such works they mention the first descriptions that have been given of supposed new species or genera, the "British Museum Catalogue of Fishes;" Jordan and Gilbert's "Synopsis," and "other works in which special information is given." No objection could be taken to the adoption of this principle, but we fail to see that the authors have strictly adhered to it. What we expect in a work specially devoted to a fauna, is full reference to every paper in which our knowledge of the species of that fauna has been advanced in some respect. Considering the vast amount of ichthyological literature scattered through the American periodicals, a more perfect collection and arrangement of references would have been of great benefit to the student, though, we admit, a work of considerable labour.

We will mention only one case to show that the scantiness in their references may even cause inconvenience to the student. The ichthyological parts of the Reports of the United States Survey Expeditions were prepared by Charles Girard, and published about the middle of the present century; they form a considerable portion of those quarto volumes, and were very liberally illustrated. A great number of forms were described in them, and we learned from them at any rate that a large contribution to our knowledge of the American fauna had been made in the collections of those expeditions. Unfortunately, the treatment of the subject by the naturalist mentioned was not satisfactory, and it seemed most desirable that the typical specimens should be re-examined and the descriptions revised. What position, now, do these reports take in the "Fishes of North and Middle America"? Indeed, the names of the Girardian species appear therein without exception, many as synonymous with other species, a part as valid species, but reference to an examination of the several types is made only in some of the cases. Thus, of eighteen species described by Girard as *Alburnops* and *Moniana*, reference to a type is made only in eight. Further, the authors refer only to preliminary descriptions in the *Proceedings* of the Philadelphia Academy, rarely to the enlarged edition in the "Reports," and almost every mention of the numerous illustrations prepared and published at the expense of the United States Government is omitted. Probably, a great number of those types, which were deposited in the Museum of the Smithsonian Institution, are lost by this time, thus depriving the identifications made by Drs. Jordan and Evermann of much of their authoritative value or finality. Possibly, the authors consider those reports, or at least the illustrations, not reliable enough to be safely quoted: an opinion expressed by the writer of this notice some thirty years ago; but it would have been well if the authors had given some explanation of the matter in their preface or introductory note.

A work like the one under review, composed at it is of an immense amount of technical details, which only too frequently have to be gathered from imperfect or even misleading sources, cannot fail to lay itself open to criticism on points of minor importance. But it would be most unjust to the authors to allow such real or supposed imperfections to detract from the high merits of their work. It was one of the greatest desiderata in Ichthyology. It is a faithful representation of our present knowledge of American fishes, and will form the basis for all researches in that field for some time to come. For how many years? Those are, in our experience, the most useful systematic works which most stimulate the activity of new workers, and, as a natural consequence, soonest yield their position to the progress of discovery and the accumulation of new facts. We anticipate that the "Fishes of North and Middle America" will prove to be one of those works, and hope that, when once a new edition will be required, the strength and knowledge of the authors will still be available for this task. Next to the authors, science is greatly indebted to the Secretary of the Smithsonian Institution for having undertaken the publication of such an extensive work, following so soon the appearance of "Oceanic Ichthyology." The publication of these two monumental works in Ichthology stand now to the credit of the Smithsonian Institution. A. G.

ASTRONOMICAL PHOTOGRAPHY.

Die Photographie der Gestirne. Von Dr. J. Scheiner, a.o. Professor der Astrophysik an der Universität Berlin, und Astronom am Königl. Astrophysikalischen Observatorium zu Potsdam. Pp. iv + 382; 1 plate and 52 figures, with an atlas of 11 plates. (Leipzig: Engelmann, 1897.)

DR. SCHEINER'S book has been before the public for some time, and it is to be regretted that we have not had an earlier opportunity of calling attention to its contents and expressing an opinion on its merits. For a book of this character cannot but grow out of date as processes become obsolete, and as improved methods are adapted. Astronomical photography is essentially a progressive science, and when Prof. Scheiner compiled this book, many of the methods employed were admittedly tentative and not accepted beyond dispute. The direction of the further development of photographic practice was not decided, and even the instrumental equipment best adapted to its ends was, and still is, not settled with certainty. This is no proof that such a book was not needed, nor does it imply that Prof. Scheiner's attempt was hasty and ill-advised; but it does affect the point of view from which the book is to be regarded at the present day. A second edition is needed to bring the matter up to date in all particulars, and this will no doubt be forthcoming; but in any case the book will stand as a valuable record, supplied by an expert, of the methods in which the problem of photographic production and measurement was applied before familiarity and experience had shaped the most suitable method of treatment. The author is already favourably known as a writer of high-class text-books dealing with practical work in the observatory, and we can have no hesitation in saying that this book will add to his reputation and that of the Potsdam Observatory, whose staff have from time to time issued a welcome series of manuals.

Dr. Scheiner treats his subject under three divisions. First, the production and utilisation of photographs; secondly, photographic photometry and the nature of the photographic image; and thirdly, the history of astronomical photography and its results. This arrangement seems satisfactory, and permits the author to group his facts clearly about the main points at issue, but we doubt whether in the future so much importance will be attached to photometrical measurement, as the prominence here given to that subject seems to intimate. There are not wanting signs that we shall be content to guess the magnitude of a star from its appearance on the film, just as we judge of its brilliancy in the telescope, though there will always remain specialists who will be content to gather their facts much more slowly, and possibly with greater accuracy, by rigorous measurement of the disc.

In the first part we have some valuable remarks on photographic technique, in which the author's practical knowledge is shown to great advantage. Of the different methods of development to produce definite results, probably we know as much as we ever shall, but it is not easy to convey the necessary information by precept. No student would, however, content himself with mere book knowledge, but would have recourse to actual manipulation in the laboratory, and the value of this preliminary chapter would be forced upon his attention. The second chapter contains a discussion of the ordinary forms of object glasses and mirrors suitable to photographic work, and attention is called to the errors that arise, whether from the construction of the optical parts, or from the manner in which the image is received on the sensitised film. The remarks are clear and pertinent; but if the chapter were to be written anew, it would probably be felt desirable to dwell more on the photographic doublet, and to contrast the amount of its distortion with that of the ordinary object glass. The peculiarities and advantages arising under certain circumstances from greater variation in the focal length to the aperture might have to be considered, and the peculiar forms of cœlostat now in use would demand more attention.

In the next and most important chapter, on the methods of measurement and reduction, the author has adhered perhaps rather too strictly to the historical than to the practical side of the question. It would have been, we submit, of greater service to the astronomical student to have possessed in the fullest detail that method which experience has shown to be of the greatest utility, illustrated by a numerical example, than the reproduction of a variety of processes which have not met with general approval. And since Dr. Scheiner has already published no insignificant portion of the catalogue of that part of the sky allotted to him by the International Committee, his experience would have enabled him to speak with authority on this vexed question of reduction. Or, disliking this method of selection, he might have worked out an example by the different methods, and thus furnished us with the means of exercising our judgment on this important question. The historical student may hereafter be very grateful to him for collecting the methods, which were suggested in the early days, before the photographs existed in any considerable numbers and ingenuity could run riot, untrammelled with the weight of the heavy numerical calculations that must come after. He may choose to weigh and contrast the methods of Bakhuyzen and Jacobi for rectangular, with that of Gill, arranged for polar, co-ordinates. He may linger over the ingenious device of M. Lœwy, or take refuge in the more practical method due to Prof. Turner; but in any case he would have been more grateful to the author if he had introduced a uniform notation, and so made the different methods more easily comparable. By simply reproducing the methods as they are given in the original memoirs, Dr. Scheiner has missed an excellent opportunity for rendering an essential service to the cause of clearness and order. This section is apparently complete up to the time of compilation, but various improvements have been suggested since, which could not possibly find a place here. We are probably far from hearing the last word on this subject of reduction, and possibly still further from the adoption of any method that will commend itself to all the participants in the international scheme, and ensure, or at least attempt, a uniform standard of accuracy. In the last chapter of the first section the author deals with the automatic registration of star transits and of latitude determinations by means of photography. These attempts are admittedly in an experimental stage, and some of the instruments by which it is proposed to compass the desired end still exist only on paper. The Observatory of Georgetown appears to be leading the way, but we have no figures by which we can judge of the measure of success that has attended the application. Prof. Turner's proposed form of photographic transit is apparently of too recent a date to obtain a critical notice; the same remark applies to Sir R. Ball's telescope at Cambridge.

On the subject of photographic photometry, which forms the second section of the book, the author is quite on his own ground, and, writing with authority, he gives us the most complete exposition of the methods which has yet appeared. It is a subject which early attracted attention, when photography first attacked the question of astronomy of position, since many of the decisions of the International Committee were founded upon more or less imperfect knowledge of the growth of the image, and the relations between the time of exposure and the magnitude of a star photographed in a given time. Much information, not all of which was consistent, was rapidly accumulated, and the author deals with this mass of material very satisfactorily. Some of the formulæ which have been suggested, and which are here quoted, for determining the radius of the star image, or deriving the photographic magnitude, were admittedly only convenient methods of interpolation, and any attempt to show that such formulæ possess a physical basis is of doubtful policy, and will hardly be everywhere accepted; but the practical value of the chapter is high, and gains immensely from the fact that the author incorporates much of the results of his own original investigations.

In the history of photography we come naturally upon more popular ground. We have an instructive, and on the whole complete, picture of the achievements of photography applied to the heavens. The section treats each object, such as the moon, the sun, &c., separately, the history of each being treated independently of the others. The later results obtained from recent eclipse expeditions are of course wanting, and possibly a little too much space is given to the Transit of Venus. The photographic reproductions that illustrate this section are excellent, and make a handsome addition to a very valuable treatise. A bibliography accompanies the work, which already needs extension, so frequent are the contributions to this attractive development of astronomy.

OUR BOOK SHELF.

Euclid's Elements of Geometry. By Charles Smith and Sophie Bryant. Pp. vi+127. (London: Macmillan and Co., Ltd., 1899.)

THIS book deals only with Euclid's Books III. and IV. Although the original order of the propositions has been maintained, there are many divergences as regards the treatment of his methods. In the modern teaching of Euclid's propositions the student is not so restricted as to particular methods of solution as long as the method he employs is accurate. The learning of propositions by heart is, we hope, a relic of the past, and the compilers of this work encourage the ingenuity of the student. In Book III. the method of superposition is used with advantage. In addition to numerous exercises, the appendix contains many interesting and important theorems and problems. As a school course this edition should be found useful.

A First Book in Statics and Dynamics. By Rev. J. R. Robinson. Pp. viii+98. (Longmans, Green and Co., 1899.)

THIS book is intended only for beginners, and specially for those who are preparing for the matriculation in the University of London and for the elementary stage of South Kensington examination. For this reason only a limited knowledge of Euclid, algebra and trigonometry is assumed in the treatment of the subject, and the text is accompanied by numerous representative examples. The author's large experience in teaching the subject has enabled him to place clearly before his readers portions which are usually stumbling-blocks for the beginner, and the numerous clearly-printed diagrams add greatly to the explanations in the text.

Life and Happiness. By Auguste Marrot. Pp. 90. (London: Kegan Paul, Trench, Trübner and Co., Ltd. Paris: Libraire Fischbacher.)

HAPPINESS is too much a matter of temperament for the perusal of these chatty little essays on the laws of health, the development of the mind, and similar subjects, to very much affect the reader's share of this desirable possession. But there can be very little doubt that the observance of some of the rules for the preservation of health here laid down will do a great deal in removing definite causes of physical discomfort—and in this way unhappiness may, at least, be diminished.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

On the Carriers in the Kathode Rays.

IN a former communication to these columns of NATURE (January 19, 1899), I showed that an upper limit for the density of the matter composing the kathode rays can be deduced from the fact that a shaft of rays emitted from a plane kathode retains its cylindrical form. The result arrived at was that the density must be small compared with 10^{-15} grams per cubic centimetre. In a subsequent note (February 16), I called attention to some results of E. Riecke, which seemed to indicate a value as low as 10^{-20} grams per cubic centimetre.

The researches of Prof. J. J. Thomson have now put us in possession of information as to the mass of the individual carriers. Using the value which he has given (*Phil. Mag.* December 1899) for the mass of a "corpuscle" in connection with the above estimate of the density of the stream, we can obtain a limiting value for the number of corpuscles per cubic centimetre. I find that this leads to a number very much smaller than that indicated by the kinetic theory for the average number of molecules per cubic centimetre in the vacuum tube.

We have, in round numbers, 2×10^{-20} for the charge on a corpuscle in electromagnetic units, and 6×10^{6} for the ratio of charge to mass, giving $\frac{1}{3} \times 10^{-26}$ grams for the mass. If then, the density is small compared with 10^{-15} grams per cubic centimetre, the number per cubic centimetre must be small compared with 3×10^{11}. In Meyer's "Kinetic Theory of Gases" (English translation, p. 333) the number of molecules present in a cubic centimetre of gas at atmospheric pressure is given as 60×10^{18}, so that in the vacuum tube the number would be of the order of 10^{16}. Thus the carriers in the kathode stream are very sparsely scattered as compared with this average.

Another point which may be worth mentioning arises in connection with Prof. Thomson's suggestion, that the mass of the corpuscle may be of electrical origin. He shows (*loc. cit.*, p. 563) that, in order to account for the effective mass in this way, the radius of the corpuscle, supposed spherical, would require to be of order 10^{-13} centimetre. The various lines of argument employed to arrive at an estimate of the size of a *molecule*, or of the "molecular sphere," agree in making its dimensions comparable with 10^{-7} centimetre. In order that a molecule of this size should be built up of, say, two atoms, each consisting of a complex of even a thousand corpuscles of radius 10^{-13} centimetre, these ultimate elements of a molecular structure would require to be very widely spaced in proportion to their dimensions.

W. B. MORTON.

Queen's College, Belfast, February 6.

Drunkenness and the Weather.

NATURE, in its issue for November 16 (1899), did me the honour of devoting considerable space to a modest publication of mine, "Conduct and the Weather," a fact to which I feel free to allude, since the reviewer found so little to praise. One remark of his, however, was suggestive to one "bound hand and foot by the demon of statistics." In commenting upon the indicated excesses of arrests for assault and battery during the hot summer months he says, "In our own ignorance we were rather tempted to attribute these lapses of good conduct to too free indulgence in alcoholic beverages in the hot weather." Here was a cue worth following out. The data were available, why not use them?

The plan followed was the same that found so little merit in the eyes of the jocular reviewer, but even at the risk of tempting him to again couch his lance, I shall outline it somewhat in detail. The general plan is that of comparing the normal daily prevalence of any abnormality of conduct with its prevalence under definite weather conditions. It necessitates a daily record of the crime to be studied, and some daily record of the weather conditions.

In the study of drunkenness, the data were taken from the records of the New York City Police Force. From them were copied the exact number of arrests for that crime for each one of the 1095 days of the three years 1893-94-95; 44,495 in all (males). The necessary meteorological data were obtained at